

Phase 1 Desktop Survey

Outfall Cottages,
Dering Way, Gravesend,
DA12 2QH

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Section 1: Desk Study

1.1 Objectives

- To identify and assess the risk to the environment and adjacent properties.
- To identify the risk to those working on site and to subsequent users or occupiers.
- To determine whether further information and investigation may be required.

1.2 Contact Details

Site Owner: Richard Lawson

Communication: Email: rlawals@icloud.com

1.3 Site Location and Development Description

The site is located on the outskirts of Gravesend near the River Thames within a southern water sewage works. The immediately adjacent area is a built-up area mainly comprising industrial units. However, there is a significant development of housing in the surrounding areas of Denton, Milton, and Chalk. The existing site contains 1116m² (0.1116ha) of hardstanding and grass. The permeable grass equates to 734m² (0.0734ha) of grass cover. See Figures 1 and 2 for marked location on a map.



Figure 1. Map showing the site location of Outfall Cottages, Dering Way, Gravesend, DA12 2QH, outlined in red. (KCC Heritage Maps, 2021).



Figure 2. Ariel image showing the site of Outfall Cottages, Dering Way, Gravesend, DA12 2QH. It can be seen that the adjacent area is mostly of an industrial nature, development of this site as proposed would be in keeping with the development of the surrounding area. (Google Maps, 2021)

It is proposed to demolish the semi-detached dwellings and erect office container units on the site connecting to the existing surface water drainage and the existing foul sewage drainage.

The proposed site contains 1116m² (0.1116ha) of hardstanding, permeable hard-standing, and grass. The permeable hardstanding and grass area equate to 541m² (0.0541ha).

The proposed development site will cause permeable areas to reduce slightly post-development. However, nearly half of the development area will remain permeable, this means the surface runoff should be sufficient as a result of the proposed development albeit existing ground conditions are acceptable.

1.4 Existing ground conditions

The site's bedrock geology has been identified by the British Geological Survey's public mapping model as the Lewes Nodular chalk formation, Seaford chalk formation, and Newhaven chalk Formation (undifferentiated) - Chalk.

The Superficial deposit records have been held by the BGS public mapping and have shown as alluvium - clay, silt, sand, and peat. Soil infiltration tests have not been provided therefore the closest BGS boreholes to the site have been selected, at Gravesend sewage treatment works, to assess the soil conditions. Results are displayed in figure 3.

Based on these boreholes, the ground formation would be categorised as a mixture of clay, silt, and blue silty clay. This type of soil is generally deemed to have poor infiltration rates. As such, It is recommended that infiltration tests are carried out at the detailed design stage to obtain a better understanding of the ground conditions.

TQ 67 SE 39 TQ 67/62 100 67/62

* For site use only GEOLOGICAL ASSIGNMENT	NATURE OF STRATA <i>If measurements start below ground surface, state how far.</i>	THICKNESS			DEPTH		
		Feet	Inches	Metres	Feet	Inches	Metres
21ft	Made ground			2			2
1st Geological Survey	Soft silty clay/peat			10			12
	Light grey/Green Clay			5			17
	Dark Blue Clay			1.5			18.5
6.1m	Clay and Stones			1.5			20.0
7.8	Sand and Gravel			5.5			25.5
	Bubble Chalk and Flints			3.5			29.0
ppr Chalk	Chalk and Flints			47.0			76.0
125T							
3/82							

Figure 3. BGS borehole report carried out near the site of Outfall cottages, at Gravesend water treatment works. (BGS, 2021)

Site Photos











Environmental

Regulatory authority information relevant to the site and its surroundings has been obtained from the undertaking of an environmental database search. The information is summarised below, and the environmental database records are enclosed in Appendix. Distances stated are approximate and are taken from the boundary of the site to the database recorded entries.

The following summary is generally limited to locations within 250 m of the site boundaries unless it is considered that installations or activities beyond that range could potentially have an impact on the site or be affected by the development at the site.

Pollution Control

The presence of pollution controls related to industrial processes at or within 250 m of the site boundary have been summarised in tables below

Control	On Site	Off Site
Contaminated Land Register Entries	No	No
Integrated Pollution Controls	No	No
Integrated Pollution Prevention	No	Yes
Local Authority Integrated Pollution Prevention	No	No
Local Authority Integrated Pollution Controls	No	No

Control Offsite	Name/Location	Direction	Details
Integrated Pollution Prevention	Southern Water Services Ltd Waste Water Treatment Work	Southeast	Permit Ref QP3337QC Activity: New Medium Combustion Plant

Pollution Incidents

Records of substantiated pollution incidents. Since 2006 this data has only included category 1 (major) and 2 (significant) pollution incidents.

ID	Location	Details	
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B	102m SW	Incident Date: 07/05/2004 Incident Identification: 234990 Pollutant: Contaminated Water:Sewage Materials Pollutant Description: Other Contaminated Water:Crude Sewage	Water Impact: Category 2 (Significant) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
B	102m SW	Incident Date: 07/05/2004 Incident Identification: 234990 Pollutant: Contaminated Water Pollutant Description: Other Contaminated Water	Water Impact: Category 2 (Significant) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
B	102m SW	Incident Date: 07/05/2004 Incident Identification: 234990 Pollutant: Sewage Materials Pollutant Description: Crude Sewage	Water Impact: Category 2 (Significant) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
B	102m SW	Incident Date: 05/07/2004 Incident Identification: 234990 Pollutant: Contaminated Water : Sewage Materials Pollutant Description: Other Contaminated Water :Crude Sewage	Water Impact: Category 2 (Significant) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
C	119m E	Incident Date: 21/01/2003 Incident Identification: 132304 Pollutant: Atmospheric Pollutants and Effects Pollutant Description: Ammonia/Amine Odour	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 3 (Minor)
F	228m W	Incident Date: 23/02/2004 Incident Identification: 218671 Pollutant: Specific Waste Materials Pollutant Description: Other Specific Waste Material	Water Impact: Category 4 (No Impact) Land Impact: Category 2 (Significant) Air Impact: Category 4 (No Impact)
I	308m NW	Incident Date: 30/04/2003 Incident Identification: 155229 Pollutant: Contaminated Water Pollutant Description: Firefighting Run-Off	Water Impact: Category 3 (Minor) Land Impact: Category 3 (Minor) Air Impact: Category 3 (Minor)
I	312m NW	Incident Date: 28/04/2001 Incident Identification: 9628 Pollutant: Contaminated Water Pollutant Description: Firefighting Run-Off	Water Impact: Category 3 (Minor) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
9	375m NW	Incident Date: 08/04/2002 Incident Identification: 69772 Pollutant: Specific Waste Materials Pollutant Description: Other Non-Metal Wastes	Water Impact: Category 4 (No Impact) Land Impact: Category 3 (Minor) Air Impact: Category 3 (Minor)
10	389m NW	Incident Date: 17/01/2003 Incident Identification: 131602 Pollutant: Oils and Fuel Pollutant Description: Other Oil or Fuel	Water Impact: Category 3 (Minor) Land Impact: Category 3 (Minor) Air Impact: Category 4 (No Impact)
12	405m N	Incident Date: 10/06/2002 Incident Identification: 83934 Pollutant: Inert Materials and Wastes Pollutant Description: Soils and Clay	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
13	485m NW	Incident Date: 01/08/2003 Incident Identification: 178273 Pollutant: Inert Materials and Wastes Pollutant Description: Other Inert Material or Waste	Water Impact: Category 4 (No Impact) Land Impact: Category 3 (Minor) Air Impact: Category 4 (No Impact)

Waste

Site Setting and Current Land Use the site is generally flat and gently slopes to the north and south from the centre of the site. The presence of waste facilities at or within 250 m of the site boundary have been summarised in table below

Facility Type	On Site	Off Site
BGS recorded Landfill Sites	No	No
Integrated Pollution Control Registered Waste Sites	No	No
Licensed Waste Management Facilities (Landfill Boundaries)	No	No
Licensed Waste Management Facilities (Locations)	No	No
Local Authority Landfill Coverage	No	No
Local Authority Recorded Landfill Sites	No	No
Registered Landfill Sites	No	No
Registered Waste Transfer Sites	No	No
Registered Waste Treatment or Disposal Sites	No	No
Historical Landfill Site	No	Yes

Landfill Site Name/Location	Direction	Details
Denton-Comma Oil	North East	Ref EAHLD19298 Waste Type: Inert Holder: J Clubb Limited
Gas Works - Canal	North West	Ref EAHLD19292 Waste Type: Inert & Commercial Holder:
Shamrock Road	East	Ref EAHLD19301 Waste Type: Inert & Household Holder: Gravesham Borough council
Norfolk Road	North West	Ref EAHLD19290 Waste Type: Inert & Commercial Holder:
Gasworks - Canal	North West	Ref EAHLD19294 Waste Type: Inert & Commercial Holder:

Hazardous Substances

Facility Type	On Site	Off Site
Registered Radioactive Substances	No	No
Control of Major Hazards Sites	No	No
Explosive Sites	No	No
Notification of Installations Handling Hazardous	No	No
Planning Hazardous Substances Consents	No	No
Planning Hazardous Substances Enforcements	No	No

Sensitive Areas

The presence of environmentally sensitive areas within 250m of the site boundary are summaries below

Feature / Designation	On Site	Off Site
Ancient Woodland	No	No
Areas of Adopted Green Belt	No	No
Areas of Unadopted Green Belt	No	No
Areas of Outstanding Natural Beauty	No	No
Environmentally Sensitive Areas	Yes	Yes
Forest Parks	No	No
Local Nature Reserves	No	No
Marine Nature Reserves	No	No
National Nature Reserves	No	No
National Parks	No	No
Nitrate Sensitive Areas o	No	No
Nitrate Vulnerable Zones (NVZ)	No	No
Ramsar Sites	No	No
Sites of Special Scientific Interest	No	No
Special Areas of Conservation	No	No

Special Protection Areas	No	No
World Heritage Sites	No	No

Historical Land Uses

The historical development of the site and surrounding area has been assessed using information available from historical Ordnance Survey (OS) maps within the Environmental Database Report for the site which are presented in Appendix of this report.

In the context of the summary of historical development of the surrounding area, the descriptions are limited to within approximately 100 m of the site boundary, unless specified in the following section.

Site History

Table below provides a detailed account of the review of available OS mapping coverage dating back to 1864.

Feature	Map Years	Notes
Denton Marshes	1869 – 2013	Earliest maps shows the site and surrounding area to be the Denton Marshes. The marshes are no longer shown on 2014 google imaging. An area of hardstanding is shown on google imaging of 2014. There is possibly a stockpile on the northern end of the site in 2011.
Drain	Pre 1869 – Present	Running in a north – south alignment along eastern boundary.
Drain	Pre 1869 – 1931	Running in a north west – south east alignment from the north west corner of the site to the centre. No longer present by 1955 mapping.
Undeveloped Land	2014 – 2019	Area of undeveloped land is shown on google imaging from 2014. Google imaging from 2019 shows that development of the site has began.
Storage Yard	2020 – Present	The present day buildings and storage yard are shown on google imaging from 2020.

Surrounding History

There are number of potentially contaminative uses near to the site; the main ones within 100 m of the site boundary are listed in Table below.

Feature	Map Years	Distance (Direction)	Notes
Sewage Works	1932 – Present	Adjacent (east)	A sewage works and associated tanks. Expanded by 1936 mapping to include sludge beds, filter beds, sediment tanks and syphon tanks.
Pipe Line	1960 – Present	10 m (south-west)	Associated with the sewage works.
Drain	1955 – 1982	20 m (south-west)	No longer shown on 1982 mapping.

Drain	1954 – 1975	50 m (north-west)	Assumed infilled or culverted. No longer shown on 1975 mapping.
Cutting / Embankment	1869 – Present	90 m (north)	

Geology, Groundwater, Hydrology and Radon

Superficial Geology

Generalised geology data based on BGS's published poster maps of the UK (North and South). Superficial related themes digitised from 1977 first edition Quaternary map (North and South).

Location	Lex code	Description	Rock type
On site	ALV-CLSS	ALLUVIUM	CLAY, SILT AND SAND

Bed Rock Geology

Generalised geology data based on BGS's published poster maps of the UK (North and South). Bedrock related themes created through generalisation of 1:50,000 data.

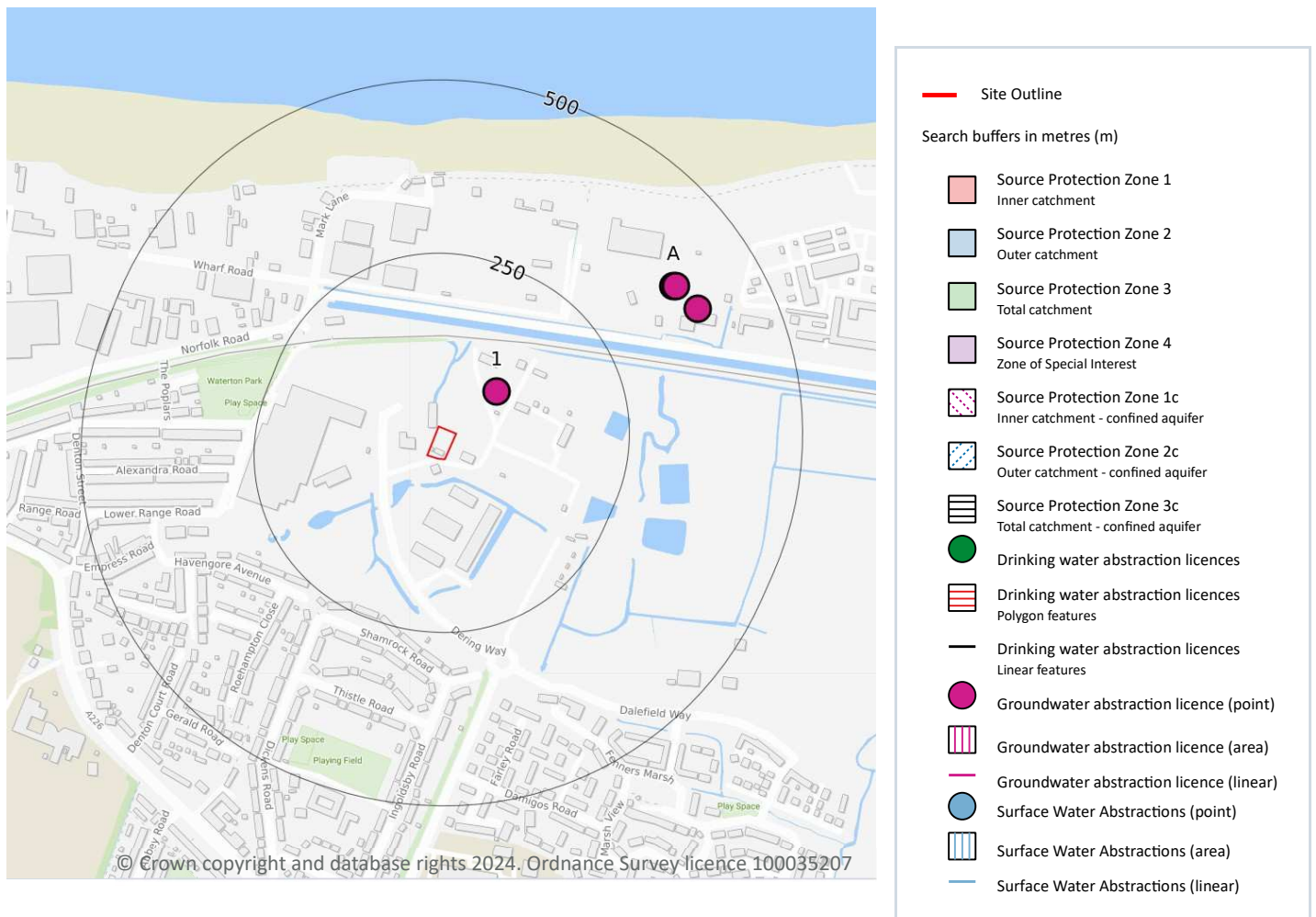
Location	Lex code	Description	Rock type
On site	WHCK-CHLK	WHITE CHALK SUBGROUP	CHALK

Superficial Aquifer

Aquifer status of groundwater held within superficial geology.

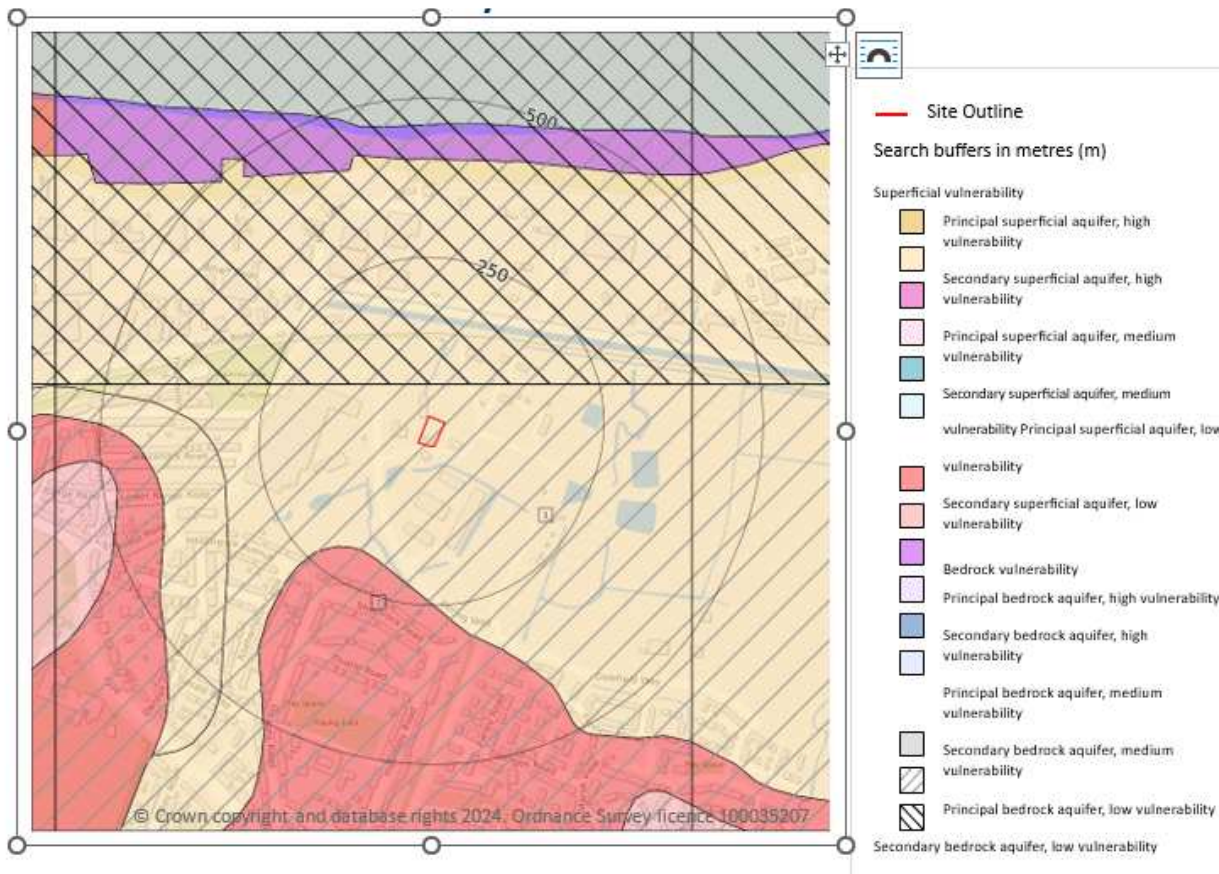
Location	Designation	Description
On site	Secondary Undifferentiated	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and nonaquifer in different locations due to the variable characteristics of the rock type

Abstractions and Source Protection Zones



Groundwater abstractions

Licensed groundwater abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, between two points (line data) or a larger area.



An assessment of the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties within a one kilometre square grid.

Groundwater vulnerability is described as High, Medium or Low as follows:

- High - Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits.
- Medium - Intermediate between high and low vulnerability.
- Low - Areas that provide the greatest protection from pollution. They are likely to be characterised by low leaching soils and/or the presence of superficial deposits characterised by a low permeability.

Location	Summary	Soil / surface	Superficial geology	Bedrock geology
On site	Summary Classification: Secondary superficial aquifer - High Vulnerability Combined classification: Productive Bedrock Aquifer, Productive Superficial Aquifer	Leaching class: Intermediate Infiltration value: >70% Dilution value: <300mm/year	Vulnerability: High Aquifer type: Secondary Thickness: 3-10m Patchiness value: <90% Recharge potential: Low	Vulnerability: High Aquifer type: Principal Flow mechanism: Well connected fractures

Groundwater vulnerability- soluble rock risk

This dataset identifies areas where solution features that enable rapid movement of a pollutant may be present within a 1km grid square.

ID	Maximum soluble risk category	Percentage of grid square covered by maximum risk
2	Very significant soluble rocks are likely to be present with a high possibility of localised subsidence or dissolution-related degradation of bedrock occurring naturally, especially in adverse conditions such as concentrated surface or subsurface water flow.	1.0%

Conceptual Site Model and Qualitative Risk Assessment

Land contamination is assessed through the identification of Potential Contaminative Linkages (PCLs). The assessment involves the development of a Conceptual Site Model (CSM) which describes the relationship between on and off site potential sources of contamination (and contaminants), potential receptors to such contamination and anticipated pathways between the two. Where all three (source-pathway-receptor linkage) are present or considered to be present, they are described as a PCL which can be subject to the risk assessment process. The following discusses the potential sources, pathways and receptors present.

Potential Sources

Potential Sources	Contaminants
Made Ground associated with historic landfill and infilled land although it is worth noting the aerial photographs do not show direct evidence of off site landfill activities having occurred.	Contaminants of potential concern include asbestos, metals, cyanides, sulphates, phenols, polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPHs) including oils, greases, solvents, Volatile Organic Compounds (VOCs) and Semi Volatile Organic Compounds (SVOCs) and ground gas
Made Ground associated with infilled land	Contaminants of potential concern include asbestos, metals, cyanide, sulphates, phenols, PAHs, TPHs including soils, greases, solvents, VOCs, SVOCs and ground gas
Sewage Works located to the east of the site	Contaminants of potential concern include leachates potentially including metals, organic compounds, inorganic compounds, asbestos and ground gas (DOE, 1995)

Potential Receptors and Pathways

Receptors	Pathways
Human Health	
Current and future site users (commercial) Neighbouring site users (commercial)	Direct exposure through dermal contact, ingestion or inhalation of soils/dusts and asbestos fibres in areas visited by site users not covered in hardstanding. Inhalation of volatile contaminants and hazardous ground gases (carbon dioxide and methane)
Maintenance Workers	If maintenance of the site includes breaking of ground, there is the potential for workers to be exposed to contaminants through: Direct exposure through dermal contact, ingestion or inhalation of soils and dusts during construction works. Inhalation of asbestos containing soils and dusts.
Controlled Waters	
Superficial Deposits – Secondary Undifferentiated Aquifer Seaford Chalk Formation – Principal Aquifer	Leaching, dissolution and migration of contaminants from existing unsaturated soils Vertical migration through the creation of preferential pathways
Surface Waters - Drains	Lateral migration and discharge of groundwater and surface water runoff
Building and Utilities	
Concrete Apron	Direct contact with concrete
Potable Supply Pipes	Diffusion into services

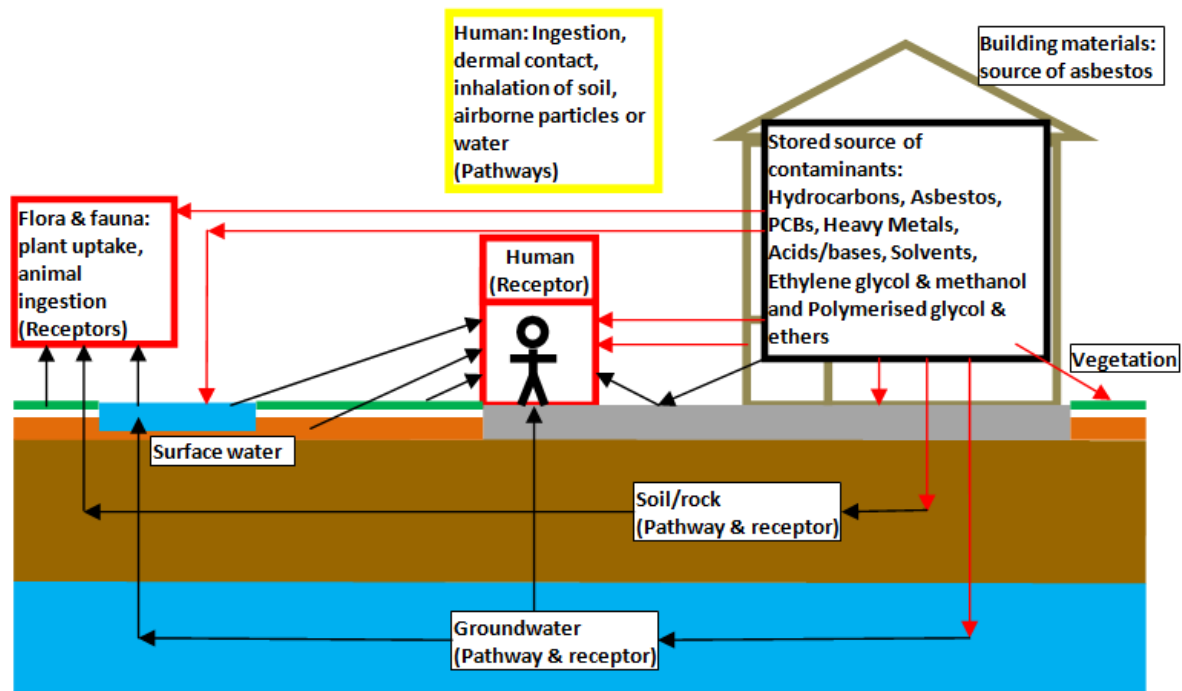
Preliminary Conceptual Site Model and Qualitative Risk Assessment

A combination of probability and consequences produces a risk level based on the risk evaluation and likely action required. The land contamination risk, which is a function of the probability and the consequence, can be defined using the risk matrix.

Pathway	Receptor	Potential	Likelihood	Overall	Comment
Dermal contact, ingestion and	Humans	Med	Unlikely	Low	The short-term risks associated with the

inhalation of soils, dust and asbestos fibres. Inhalation of volatile contaminants.					maintenance works would be managed through proper implementation of PPE and good working and hygiene practices, hence the low classification.
Leaching and migration from unsaturated contaminated soils.	Groundwater	Med	Unlikely	Low	Contaminants present in the Made Ground have the potential to migrate into the underlying aquifer. The site is covered in hardstanding, which is likely to reduce infiltration. No preferential pathways have been created via the foundation arrangements for the structures, this reduces the leaching and migration potential from unsaturated soils
Direct contact and diffusion through drinking water pipes.	Concrete Apron	Med	Unlikely	Low	Potential contamination if present could impact the integrity of concrete by creating aggressive ground conditions, however, the construction make up indicates that there is a layer of rubble fill between the deeper Made Ground and the concrete which would limit the direct contact with underlying site soils. Potential organic contaminants could permeate into potable water supply lines having an adverse impact on human health. It is understood that the new potable pipes were laid in a clean service trench and are laid within the

					rubble fill directly below the concrete therefore the potential for direct contact is limited.
Gas and vapour migration and accumulation in buildings.	Existing building/humans	Severe	Unlikely	Moderate to low	The apparent former landfill on the development accepted inert material which by its nature should not produce ground gas. It is understood that the current on site structures have a ventilated cavity beneath the floor. The void below the reduces the likelihood of the potential of ground gas and vapours to accumulate
Lateral and vertical migration of groundwater	Groundwater	Med	Low	Moderate to low	There is a potential for contaminants to migrate onto the site through permeable Superficial deposits and Bedrock



Summary and Conclusions

Edge - Enviro Services Ltd was commissioned by Richard Lawson to undertake a Contaminated Land Desktop Study to accompany a planning application for the development of Outfall Cottages, Dering Way, Gravesend, DA12 2QH.

Based on the findings the following conclusions can be made for human health:

The risk posed by sources of contamination with the exception of ground gas is considered to be Low.

The risk posed by potential on and off site sources of ground gas to human health receptors is considered to be Moderate to Low.

Summary of Controlled Waters Risk Assessment Based on the findings of the PRA, the following conclusions can be made for controlled waters:

The risk posed by on site sources of contamination to groundwater and surface water receptors is considered to be Low.

The risk posed by off site sources of contamination to groundwater underlying the site is considered to be Low.

Summary of Other Receptors Based on the findings of the PRA, the following conclusions can be made for concrete, buildings and utilities:

The risk posed by potential sources of ground gas to buildings is considered to be Moderate to low.

The risk posed by sources of potential organic contaminants permeating into potable water supply lines and from aggressive ground conditions is considered to be Moderate to low

There is a considerable amount of information in the Groundsure Report indicating a considerable amount of industrial activity around the site over many years. The site is surrounded by the water companies sewage works.

There has also been several waste and landfill sites, one virtually next door, and five others of various types within 500mtrs. One of these is a household, commercial and industrial waste site.

As the most prominent flooding is from groundwater it looks as if the damage has been done mainly by contaminated ground water, which has been able to flow through the ground contaminating Outfall Cottages from other sites.

The reality is that this site has suffered from continuous pollution over the years.

Recommendations

Due to the high amount of pollution in the ground we would suggest the following

- Demolish the buildings and out building and clear the site
- Remove some 50cm from the top of the ground and then take samples
- Put a clay barrier around the whole site down to 1.5 - 2mtr, by digging a trench approx 50cm across, then fill with clay to stop further contamination of soil by outside sources.
- Put membrane down over the plot
- Make up ground with clean soil
- Increase height of plot by some 50cm overall and build clay barrier up 50cm
- Concrete over the whole plot, this would give the required protection.
- Edge to check and oversee all operation regarding this site

Prepared by Oliver Crockford- MSc, BSc – Environmental Consultant

Checked by Nigel Collingwood – Director – Edge-Enviro Services Ltd

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